December 2011 MSS/LPS/SPS Joint Subcommittee Meeting
ABSTRACT SUBMITTAL FORM

The submission of an abstract is an agreement to complete a final paper for publication and attend the meeting to present this information. Complete all information requested in the author and co-author information sections; the first author listed will receive paper acceptance notices and all correspondence. Abstracts must be submitted electronically; submittal instructions are located in the call for papers. **The abstract deadline date is June 13, 2011.**

ABSTRACT INFORMATION

Title: Time-accurate computational fluid dynamics simulation of a pair of moving solid rocket boosters

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Unclassified Abstract

(250-300 words; do not include figures or tables)

Since the Columbia accident, the threat to the Shuttle launch vehicle from debris during the liftoff timeframe has been assessed by the Liftoff Debris Team at NASA/MSFC. In addition to engineering methods of analysis, CFD-generated flow fields during the liftoff timeframe have been used in conjunction with 3-DOF debris transport methods to predict the motion of liftoff debris. Early models made use of a quasi-steady flow field approximation with the vehicle positioned at a fixed location relative to the ground; however, a moving overset mesh capability has recently been developed for the Loci/CHEM CFD software which enables higher-fidelity simulation of the Shuttle transient plume startup and liftoff environment. The present work details the simulation of the launch pad and mobile launch platform (MLP) with truncated solid rocket boosters (SRBs) moving in a prescribed liftoff trajectory derived from Shuttle flight measurements. Using Loci/CHEM, time-accurate RANS and hybrid RANS/LES simulations were performed for the timeframe T0+0 to T0+3.5 seconds, which consists of SRB startup to a vehicle altitude of approximately 90 feet above the MLP. Analysis of the transient flowfield focuses on the evolution of the SRB plumes in the MLP plume holes and the flame trench, impingement on the flame deflector, and especially impingment on the MLP deck resulting in upward flow which is a transport mechanism for debris. The results show excellent qualitative agreement with the visual record from past Shuttle flights, and comparisons to pressure measurements in the flame trench and on the MLP provide confidence in these simulation capabilities.